

II. REMARKS

Claims 3, 9, 10, 12, 14 and 17 have been cancelled without prejudice, claims 1, 4, 11 and 20 have been amended, and new claims 21 and 22 have been added. Specifically, independent claims 1 and 20 have been amended to incorporate subject matter from previous claim 3, and to recite “wherein the acid value of component (A) is 45-200 mg KOH/g” as supported by previous claim 4 and on page 9, lines 24-25, of Applicants’ specification as originally filed. Claims 4 and 11, which depend either directly or indirectly upon independent claim 1, have been amended in accordance with the present amendment to claim 1.

New claims 21 and 22 depend respectively upon claims 1 and 20, and additionally recite “wherein the acid value of component (A) is 144-200 mg KOH/g” as supported on page 9, lines 24-45, and by the binder polymer “A1” described in paragraph [0029] of Applicants’ disclosure, which is a mixed solution of 110 g methacrylic acid, 225 g of methyl methacrylate, 135 g of ethyl acrylate, 30 g of styrene and 3 g of azobisisobutyronitrile, and which has a calculated acid value of 144 mgKOH/g based on the acid value of the monopolymer of the copolymerizing component.

The present amendment adds no new matter to the above-captioned application.

A. The Invention

The present invention pertains broadly to a photosensitive resin composition, such as may be used to manufacture a photosensitive element, and/or may be used to manufacture a printed circuit board. In accordance with an embodiment of the present invention, a photosensitive resin composition including the features recited by independent claim 1 is provided. In accordance with another embodiment of the present invention, a photosensitive

resin composition including the features recited by independent claim 20 is provided.

Various other embodiments, in accordance with the present invention, are recited by the dependent claims.

An advantage provided by the various embodiments of the present invention, is that a photosensitive resin composition is provided that exhibits improved adhesion and photosensitivity characteristics.

B. The Rejections

Claims 1, 2 and 20 stand rejected under 35 U.S.C. § 102(b) as anticipated by Grubb et al. (U.S. 3,647,467, hereafter, the “Grubb Patent”).

Claims 1-20 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Ohta et al. (U.S. 5,476,690, hereafter the “Ohta Patent”) in view of the Grubb Patent.

In view of the present amendment, Applicants respectfully traverse the present rejections and request reconsideration and allowance of the claims for the following reasons.

C. Applicants’ Arguments

i. The Section 102 Rejection

Anticipation under 35 U.S.C. § 102 requires showing the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim. Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick, 221 U.S.P.Q. 481, 485 (Fed. Cir. 1984). In this case, the Examiner has failed to establish a prima facie case of anticipation against independent claims 1 and 20 because the Grubb Patent fails to teach, or suggest, “component (B) contains a bisphenol A-type (meth)acrylate compound” as recited by these claims.

ii. The Grubb Patent

The Grubb Patent discloses “hexaarylbiimidazole-heterocyclic compound compositions,” which are photoactivatable compositions comprising a hexaarylbiimidazole and a heterocyclic compound of the formula $\text{Ar}^1\text{—G—Ar}^2$ where Ar^1 is aryl of six to 12 nuclear carbons, Ar^2 is Ar^1 or arylene—G— Ar^1 and G is a divalent furan, oxazole or oxadiazole ring, and optionally, a leuco dye and/or a polymerizable monomer or inert components such as binders and solvents, wherein the compositions are photoactivated in the near ultraviolet or visible light wavelengths (See Abstract of the Grubb Patent). More specifically, the Grubb Patent discloses a binder polymer, photopolymerizing compound with an ethylenic unsaturated bond that employs a photopolymerization initiator such as 2,4,5-triarylimidazolyl dimer and heterocyclic compounds such as 2,5-diphenylfuran (col. 3, lines 32-33 and lines 67-69).

In Example 11, col. 14, lines 34-53, of the Grubb Patent, poly(methyl methacrylate/methacrylic acid) 90/10 is employed as binder polymer in Solution B. A person of ordinary skill in the art would know that the calculated acid value for this binder polymer is 65 mg KOH/g. However, the Grubb Patent does not specifically disclose adjusting the acid value of the binder polymer to accord with the range of 45-200 mg KOH/g as recited by independent claims 1 and 20. None of the other specific examples disclosed by the Grubb Patent include a binder polymer having an acid value in the range of 45-200 mg KOH/g.

The Grubb Patent, however, does not teach, or suggest, “a photopolymerizing compound with an ethylenic unsaturated bond...[that] contains a bisphenol A-type (meth)acrylate compound” as recited by independent claims 1 and 20. The Grubb Patent also does not teach, or suggest, “the acid value of component (A) is 144-200 mg KOH/g” as recited by claims 21 and 22.

For the above reasons, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 102 because the Grubb Patent does not teach each and every limitation recited by independent claims 1 and 20.

iii. The Section 103 Rejections

A prima facie case of obviousness requires a showing that the scope and content of the prior art teaches each and every element of the claimed invention, and that the prior art provides some teaching, suggestion or motivation, or other legitimate reason, for combining the references in the manner claimed. KSR International Co. v. Teleflex Inc., 127 S.Ct. 1727, 1739-41 (2007); In re Oetiker, 24 U.S.P.Q.2d 1443 (Fed. Cir. 1992). Furthermore, a proper rejection under Section 103 requires showing that when a person of ordinary skill in the art would have had a legitimate reason to attempt to make the composition or device, or to carry out the claimed process, that the person of ordinary skill in the art would also have had a reasonable expectation of success in doing so. PharmaStem Therapeutics, Inc. v. ViaCell, Inc., 491 F.3d 1342, 1360 (Fed. Cir. 2007).

In this case, the Examiner has failed to establish a prima facie case of obviousness against independent claims 1 and 20 because (i) the combination of the Ohta Patent and the Grubb Patent does not teach, or suggest, “the acid value of component (A) is 45-200 mg KOH/g” as recited by claims 1 and 20 of the present application, (ii) the Examiner has failed to establish a legitimate reason to justify the combination of the Ohta Patent with the Grubb Patent, and (iii) because the Examiner has failed to establish that a person of ordinary skill in the art would have had a reasonable expectation of success of arriving at Applicants’ claimed invention if the combination of Ohta and Grubb were made.

iv. The Ohta Patent

The Ohta Patent discloses a “process for preparing printed circuit board” that includes the steps of: (1) forming, on the surface of an insulating substrate on a necessitate portion of which electrolessly plated copper is to be precipitated, a layer of a light-sensitive resin composition comprising (a) 40 to 80 parts by weight of a vinyl-polymerized high molecular weight binder having an acid value of 10 to 46 mgKOH/g, (b) 20 to 60 parts by weight of a compound having at least two polymerizable unsaturated double bonds in a molecule, with the total amount of Components (a) and (b) being 100 parts by weight, and (c) a photopolymerization initiator generating free radicals by irradiation of active light in an amount of 0.1 to 10 parts by weight based on 100 parts by weight of Components (a) and (b); (2) forming a negative pattern of the light-sensitive resin composition on the surface of the substrate by irradiating active light imagewisely and developing with a semi-aqueous developing solution; and (3) forming a circuit pattern by electroless copper plating by using the negative pattern of the light-sensitive resin composition on the surface of the substrate as a plating resist (See Abstract of the Ohta Patent). The Ohta Patent discloses that the binder polymer having an acid value of 10 to 46 mgKOH/g is a high molecular weight binder, that the compound having at least two polymerizable unsaturated double bonds in a molecule may be bisphenol A, and that the photopolymerization initiator may be 2,4,5-triarylimidazole dimer (Ohta Patent, col. 4, lines 5-10; col. 5, lines 55-59; and col. 6, lines 13-33).

The Ohta Patent does not teach, or even suggest, component (D) recited by independent claims 1 and 20. In particular, the Ohta Patent does not teach, or suggest, “a compound represented by the following general formula (1a), (1b), (1c), or (2)” as recited by independent claim 1, and “one or more compounds selected from the group” recited by independent claim 20.

Of note, the Ohta Patent discloses Comparative Synthetic Examples 1 and 2, wherein the binder polymers have acid values of 52 mgKOH/g and 78.2 mgKOH/g, respectively (col. 11, lines 1-35). On the other hand, the Ohta Patent discloses in the Examples at col. 8, line 59, to col. 10, line 46, binder polymers having acid values ranging from 19.6 mgKOH/g to 39.1 mgKOH/g. The Ohta Patent also explicitly states that

the copolymerization rate of the vinyl monomer having an acidic polar group such as acrylic acid, methacrylic acid and p-vinylbenzoic acid is limited to such a rate that the acid value of the vinyl-polymerized type high molecular weight binder (a) obtained by copolymerization is in the range of 10 to 46 mgKOH/g. If the acid value of the vinyl-polymerized type high molecular weight binder (a) is less than 10 mgKOH/g, developability with a semi-aqueous developing solution is lowered, while if it exceeds 46 mgKOH/g, a gap is generated between a resist and plated copper to lower resistance to electroless copper plating property. In order to obtain better developability and highly reliable resistance to electroless copper plating property, the acid value of the vinyl-polymerized type high molecular weight binder (a) is preferably in the range of 20 to 40 mgKOH/g.

(Ohta Patent, col. 5, lines 8-22, emphasis added).

Thus, the Ohta Patent explicitly teaches away from acid values exceeding 46 mgKOH/g due to the fact that such higher acid values will result in an undersirable gap between the resist and the plated copper so as to lower resistance to the electroless copper plating property. The Ohta Patent pertains to a process for preparing a printed circuit board that wherein excellent resistance to electroless copper plating is achieved and contamination of the plating solution is diminished by keeping the acid value of the binder polymer in the range of 10 to 46 mgKOH/g (col. 1, line 66, to col. 2, line 13; and col. 5, lines 8-22). Therefore, the subject matter disclosed by Ohta pertains to a completely different technical innovation than that of the present invention, and even teaches away from the limitation wherein “the acid value of component (A) is 45-200 mg KOH/g” as recited by claims 1 and 20 of the present invention, and the higher range of acid values recited by claims 21 and 22.

v. The Grubb Patent

The disclosure of the Grubb Patent is discussed above. Furthermore, the Grubb Patent pertains to hexaarylbiimidazole-heterocyclic compound compositions that achieve efficient absorption of UV radiation and improved imaging speed by combining hexaryl biimidazole and a heterocyclic compound of the formula Ar^1-G-Ar^2 . The purpose and effect of Grubb's hexaarylbiimidazole-heterocyclic compound compositions, as would be understood by a person of ordinary skill in the art, are completely different from those of the present invention.

vi. Summary of the Disclosures

The Ohta Patent discloses a process for preparing printed circuit board that includes forming, on the surface of an insulating substrate, a layer of a light-sensitive resin composition comprising (a) 40 to 80 parts by weight of a vinyl-polymerized high molecular weight binder having an acid value of 10 to 46 mgKOH/g, (b) 20 to 60 parts by weight of a compound having at least two polymerizable unsaturated double bonds in a molecule such as bisphenol A, with the total amount of Components (a) and (b) being 100 parts by weight, and (c) a photopolymerization initiator, such as 2,4,5-triarylimidazole dimer, generating free radicals by irradiation of active light in an amount of 0.1 to 10 parts by weight based on 100 parts by weight of Components (a) and (b). However, the Ohta Patent does not teach, or even suggest, component (D) such as "a compound represented by the following general formula (1a), (1b), (1c), or (2)" as recited by independent claim 1, and "one or more compounds selected from the group" recited by independent claim 20.

Furthermore, while the Ohta Patent discloses that the binder has an acid value of 10 to 46 mgKOH/g, the Ohta Patent explicitly teaches away from the binder having an acid value of greater than 46 mgKOH/g and even provides comparative examples having acid values of 52 mgKOH/g and 78.2 mgKOH/g to demonstrate the deleterious effect of employing a binder having an acid value in excess of 46 mgKOH/g. Therefore, the Ohta Patent explicitly teaches away from the limitation “the acid value of component (A) is 45-200 mg KOH/g” as recited by claims 1 and 20 of the present invention.

The Grubb Patent discloses hexaarylbiimidazole-heterocyclic compound compositions that are photoactivatable compositions comprising a hexaarylbiimidazole and a heterocyclic compound of the formula Ar^1-G-Ar^2 . However, the Grubb Patent does not teach, or suggest, “a photopolymerizing compound with an ethylenic unsaturated bond...[that] contains a bisphenol A-type (meth)acrylate compound” as recited by independent claims 1 and 20. Furthermore, while the Grubb Patent discloses a binder polymer having an acid value of 65 mg KOH/g, the Grubb Patent does not specifically disclose adjusting the acid value of the binder polymer to accord with the range of 45-200 mg KOH/g as recited by independent claims 1 and 20.

Therefore, the combination of the Ohta Patent and the Grubb Patent does not teach, or suggest, “the acid value of component (A) is 45-200 mg KOH/g” as recited by claims 1 and 20 of the present invention. The combination of the Ohta Patent and the Grubb Patent also do not teach, or suggest, “the acid value of component (A) is 144-200 mg KOH/g” as recited by claims 1 and 20 of the present invention.

It is a well-settled proposition that references that teach away from the invention cannot serve to establish a prima facie case of obviousness. McGinley v. Franklin Sports Inc., 60 U.S.P.Q.2d 1001, 1010 (Fed. Cir. 2001). Thus, the combination of the Ohta Patent and the Grubb Patent cannot be used to render obvious the claimed range of “the acid value

of component (A) is 45-200 mg KOH/g” and of “144-200 mg KOH/g” because the Ohta Patent explicitly teaches away from acid values exceeding 46 mg KOH/g! In other words, the combination of Ohta and Grubb does not teach, or suggest, the claimed acid value range and the Examiner has failed to adduce any legitimate reason for modifying the combined disclosures of Ohta and Grubb to arrive at Applicants’ claimed acid value range for the binder polymer.

For all of the above reasons, the Examiner has failed to establish a prima facie case of obviousness against claims 1, 2, 4-8, 11, 13, 15, 16 and 18-22 of the above-captioned application.

vii. No Legitimate Reason to Combine Ohta and Grubb

A prima facie case of obviousness requires a showing that the prior art provides some teaching, suggestion or motivation, or other legitimate reason, for combining the references in the manner claimed. KSR International Co. v. Teleflex Inc., 127 S.Ct. 1727, 1739-41 (2007). In this case, the Examiner has failed to establish a legitimate reason for combining the references in the manner claimed.

The Federal Circuit has held that a modification of a prior art invention that would obliterate an essential feature thereof would not be obvious. McGinley v. Franklin Sports Inc., 60 U.S.P.Q.2d at 1010-11. In this case, the Ohta Patent explicitly discloses that a binder having an acid value that does not exceed 46 mg KOH/g is an essential feature of its light-sensitive resin composition in order to achieve excellent resistance to electroless copper plating and to diminish contamination of the plating solution (Ohta Patent, col. 1, line 66, to col. 2, line 13; and col. 5, lines 8-22). Therefore, modification of the subject matter disclosed by the Ohta Patent so as to employ a binder having an acid value greater than 46 mg KOH/g is not obvious as a matter of law because to do so would obliterate an essential feature of

Ohta's resin composition, thereby diminishing its resistance to electroless copper plating and causing contamination of the plating solution. Thus, the Examiner has no legitimate reason to combine Ohta and Grubb to produce a photosensitive resin composition comprising a "binder polymer" that has an acid value of "45-200 mg KOH/g" as recited by claims 1 and 20, or a "binder polymer" that has an acid value of "144-200 mg KOH/g" as recited by claims 21 and 22.

Furthermore, the Ohta Patent pertains to a process for preparing a printed circuit board that achieves excellent resistance to electroless copper plating and diminishes contamination of the plating solution by keeping the acid value of the binder polymer in the range of 10 to 46 mgKOH/g, (Ohta Patent, col. 1, line 66, to col. 2, line 13; and col. 5, lines 8-22). On the other hand, the Grubb Patent pertains to hexaarylbiimidazole-heterocyclic compound compositions that achieve efficient absorption of UV radiation and improved imaging speed by combining hexaryl biimidazole and a heterocyclic compound of the formula Ar^1-G-Ar^2 . The present invention, however, pertains to a photosensitive resin composition that comprises components (A) to (D) wherein the "acid value of component (A) is 45-200 mg KOH/g" as recited by claims 1 and 20. For example, the binder polymer "A1" described in paragraph [0029] of Applicants' disclosure, which is a mixed solution of 110 g methacrylic acid, 225 g of methyl methacrylate, 135 g of ethyl acrylate, 30 g of styrene and 3 g of azobisisobutyronitrile, has a calculated acid value of 144 mgKOH/g based on the acid value of the monopolymer of the copolymerizing component. Thus, in accordance with another embodiment of the present invention, the "acid value of component (A) is 144-200 mg KOH/g" as recited by claims 21 and 22.

The photosensitive resin composition of the present invention unexpectedly achieves not only the property of a less contaminated plating solution (contrary to the teachings of the Ohta Patent), but it also achieves high photosensitivity, satisfactory minimization of sludge

generation during developing, high resolution, and good adhesion characteristics. Therefore, the purpose and effect of the present invention is substantially different from that of Grubb's hexaarylbiimidazole-heterocyclic compound compositions and of Ohta's light-sensitive resin composition.

For all of the above reasons, a person of ordinary skill in the art would have no legitimate reason to combine Grubb's heterocyclic compound of the formula $\text{Ar}^1\text{—G—Ar}^2$ with the subject matter of the Ohta Patent because neither of these references address the problem addressed by the present invention. For all of the above reasons, the Examiner has failed to establish a prima facie case of obviousness against claims 1, 2, 4-8, 11, 13, 15, 16 and 18-22 of the above-captioned application.

viii. No Reasonable Expectation of Success Combining Ohta and Grubb

A prima facie case of obviousness also requires a showing that, in addition to establishing a person of ordinary skill in the art would have had a legitimate reason to attempt to make the claimed composition or device or to carry out the claimed process, the person of ordinary skill in the art would have had a reasonable expectation of success in making the composition or device, or carrying out the process. PharmaStem Therapeutics, Inc. v. ViaCell, Inc., 491 F.3d 1342, 1360 (Fed. Cir. 2007). In this case, the Examiner has failed to establish that, assuming *arguendo* there is a legitimate reason for combining the references in the manner claimed (which is an invalid assumption), there would have been a reasonable expectation of success of arriving at Applicants' claimed invention.

As discussed above, the Ohta Patent teaches away from employing a binder having an acid value greater than 46 mg KOH/g due to the deleterious effects that would occur, such as plating solution contamination and diminished resistance to electroless copper plating (Ohta Patent, col. 1, line 66, to col. 2, line 13; and col. 5, lines 8-22). In view of the above facts, a

person of ordinary skill in the art would have had no reasonable expectation of success of achieving an acceptable photosensitive resin composition, much less one that has all of Applicants' claimed features including a "binder polymer" having an "acid value" of "45-200 mg KOH/g."

The above reasoning also applies to the embodiment of claims 21 and 22 wherein the "binder polymer" has an "acid value" of "144-200 mg KOH/g." In fact, because neither the Grubb Patent nor the Ohta Patent disclose a "binder polymer" having an "acid value" anywhere close to the range recited by claims 21 and 22, and because the Ohta Patent discloses that an acid value exceeding 46 mg KOH/g has detrimental properties, a person of ordinary skill in the art would have absolutely no reason to combine Grubb and Ohta to arrive at Applicants' claimed invention and the person of ordinary skill in the art would have absolutely no expectation of success of arriving at the invention recited by claims 21 and 22 by making such a combination.

For all of the above reasons, the Examiner has failed to establish a prima facie case of obviousness against claims 1, 2, 4-8, 11, 13, 15, 16 and 18-22 of the above-captioned application.

III. CONCLUSION

For all of the above reasons, claims 1, 2, 4-8, 11, 13, 15, 16 and 18-22 are now in condition for allowance. Therefore, Applicants respectfully request reconsideration of the application and withdrawal of the rejections, and a prompt notice of allowance is earnestly solicited.

Questions are welcomed by the below signed attorney for the Applicants.

Respectfully submitted,

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